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ABSTRACT

Suggestions are presented in this paper to aid in the effective selection of instructional materials appropriate to the reading levels of the students who will use them. Formulas designed to predict the readability of material are discussed. The cloze procedure, which attempts to measure, for individuals, the difficulty of text, is recommended for use with instructional materials. Caution is suggested in the use of the traditional five-word deletion pattern in the case of scientific material. Alternatives to the correct-word requirement include clozentropy, a procedure whereby a reader's responses are compared against all responses placed in the blanks by a criterion group. MKM)

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"Determining the Readability of Instructional Material"

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Instructional materials comprising commercially produced texts and supplementary work-study books and including teacher prepared booklets and study sheets are a vital aspect of all educational endeavors. They are effective means for introducing or overviewing a topic, for providing a context for introducing new terms and concepts, for gaining specific information and common experiences, and for summarizing and concluding the study of a topic. Whether texts should be used in a particular educational situation is a decision that must be made by the local educational unit and staff. The aim of this paper is to present some ideas that have implications for the effective selection of instructional materials whenever the decision is made to use them.

One concern that seems to constantly appear in the lit-

CS 003 235

erature on the use of reading materials is about their readability. No one seems to disagree that instructional materials should be demonstrably "readable" by the pupils. What seems to be a source of disagreement, and sometimes a source of confusion, is the means available for determining whether or not a set of materials is readable. The disagreement and confusion seems to result from whether one is attempting to predict or to measure the degree of readability of any text.

DEFINING READABILITY

There is substantial agreement among authors on the subject of readability as to what may affect the understanding of a particular piece of written material. Few define it simply as factors or qualities within the material itself. Most include in the definitions not only factors that reflect the language characteristics of the written message but also those that relfect characteristics of the reader and those that take into account the difficulty of the ideas within the subject matter. Some also include characteristics of the affective nature of the reading act. For example, readability could be considered as (7)

> the ease with which linguistic material in written form with (given) cognitive or emotional characteristics of content or style and presented in a (given) manner with or without supporting context is decoded--understood, learned,

remembered--by members of a (given) population.

In a similar vein, readability is considered as an estimate of reading difficulty at certain times for certain purposes, and (24)

the reader's level of performance
is a function of
the reader's level of competence
interacting with
the reader's level of motivation
interacting with
the readability of the material.

This writer (20) has proposed that readability is a "moment" at which time the reader's emotional, cognitive, and linguistic backgrounds interact with each other, with the topic, and with the proposed purposes for doing the reading, and with the author's choice of semantic and syntactic structures all within a particular setting. At such a "moment," the material is a constant on which two main sets of forces are being exerted: one, the characteristics of the reader; the other, the elements of the situation--actual and perceived.

Although there seems to be a fairly high degree of agreement as to what factors may influence readability, there is not the same degree of agreement when it comes to putting

those factors into an operational form. Educators who attempt to predict a message's difficulty seek to use those characteristics of the written message that will place the material along a continuum of selections whose "readability" scores have already been established (18). Those who attempt to measure readability seek to gain an estimate of the reader's understanding of that material as a function of the reader's language competence, the subject matter of the message, and the syntactic and morphological complexity of the message. These two approaches will be examined in an attempt to identify a means for judging the suitability of instructional materials for effective and efficient learning by a particular pupil population.

PREDICTING THE DIFFICULTY OF TEXTS

The most common means for predicting the readability of materials is through the use of "standard" readability formulas (11, 14, 19, 27, 33) which use factors such as vocabulary and sentence difficulty to sample "those characteristics of reading material which make for ease or difficulty in reading comprehension (19)." These two variables are used because they seem to represent the two factors with the highest loadings on regression equations (19, 23). Vocabulary difficulty, however, is not estimated the same in all of the formulas. In some (11, 19, 27), difficulty means unfamiliarity, that is, a word is judged difficult if it does not appear on a list of frequently used words. In others (14, 33), difficulty

is estimated by word length, that is, a word is judged more difficult as the number of its syllables increases. The rationale given for these decisions is (23): (a) that the length of a word seems to be a reflection of its familiarity, (b) that as words are used more frequently they seem to become shorter, (c) that humans seem to repeat familiar words more frequently than unfamiliar ones, and (d) that sentence length seems to correlate very highly with sentence complexity. Therefore, "as long as predictions are all that is needed, the evidence that simple word and sentence counts can provide satisfactory predictors for most purposes is quite conclusive (23)."

In order to estimate the instructional level of the materials, ratios between the word and sentence difficulties are compared to a population's performance on some criterion. The two most popular means for establishing grade equivalents has been to correlate the word/sentence difficulty ratio with a population's performance on a graded series of comprehension tests, or to compare the ratio to that found in a graded series of reading material.

The use of standard formulas has been criticised on a number of accounts. One issue is the difficulty researchers seem to have in defining the criteria of comprehensibility (3, 4, 5, 29, 35, 36). In devising many of the formulas, a percentage of correct answers on comprehension tests has been used. Any comprehension test based upon a set of questions may be only as accurate as the questions themselves since

an unpredictable variation may be introduced due to the uncontrolled ways items can be selected or phrased. Criterion scores on different tests made from the same material may represent different amounts of knowledge, that is, another examiner might possibly devise a different set of questions from the same passages that would produce different comprehension results. Also, when formulas are standardized with one type of pupil population, such as elementary school pupils, and then grade equivalents are extrapolated for use at other levels, the formula's validity for use with materials at those other levels might be questioned.

Another issue concerns the two common variables of the standard formulas, word and sentence difficulty. They are not seen as variables that can be considered to stand in a causal relationship to reading difficulty (2). Since those two variables cannot be manipulated, as can other variables such as sentence structure, anaphora, and syntactic complexity, their role in causing reading difficulties is highly questionable. Also, in regard to the use of words to estimate difficulty, the idea that shorter words are used more frequently and therefore are more predictable (with predictable implying familiarity), may be a fallacy (16). Long words are often a combination of two short words or a short word with affixes. Their "predictability" increases in relation to their redundancy so it seems to be the redundancy of words that makes them "familiar", not their length. Also, there is evidence that sentences with morphologically derived word forms are

more difficult to process than those of non-derived words (21). Difficulty seems to be due not to word length but to word form.

Using a formula to estimate the grade level of any given written material is a problem in that some formula users wish them to accurately predict a precise level of the reading matter. Scores from a formula are usable only within a range of scores since their standard errorsof measurement are often as great as one whole year (35).

Finally, some research has shown that formulas may be invalid for accurate appraisal of material with technical vocabulary (9), and they may not be sensitive to factors within subject matter areas (15). What this means is that while some formulas may rank materials of different content in an order of difficulty, they cannot distinguish between and among materials of the same content to provide a useful estimate of their probable difficulty levels.

In summary, standard formulas seem to have major shortcomings in that (a) they may be of dubious value when used with pupils or with materials that are dissimilar to those used in computing the formulas originally, and (b) they do not consider difficulty caused by factors such as concept load, format of the material, organization of the ideas, or the writing patterns. While standard formulas may have some limited appeal as predictors of readability, their usefulness does not allow one to consider why one piece of instructional material is more or less readable than another.

OTHER PREDICTORS OF TEXTUAL DIFFICULTY

Recently, much attention has been given to the role that syntactic complexity (factors other than sentence length) plays in determining the readability of written materials. As a result, there exists a formula of syntactic complexity (6) and a means for establishing a syntactic density score (22). These formulas, like standard formulas, are intended to rank selections in an order of difficulty.

The rationale for such syntactically based formulas seems to be that (17): (a) sentence length offers little indication of the grammatical make-up and complexity of a sentence, and (b) a sentence's complexity cannot be established from a word count. The originators of the formulas based their selection of variables on the results of research dealing the difficulty of different sentence transformations. The formula of syntactic complexity considers counts of such elements as simple sentences, simple transformations, coordinate clauses, nonsentence expressions, prepositional phrases, noun modifiers, adverbial modifiers, modals, infinitives, gerunds, coordinate clauses, deletion in clauses, dependent clauses, participles, and clauses used as subjects. The sentence density estimate considers counts of such elements as terminal units (T-units), subordinate and main clauses, modals, be and have forms, prepositional phrases, possessive nouns and pronouns, adverbials of time, and gerunds, participles and absolute phrases.

As an aside, it is interesting to note that the author of one standard readability formula has hypothesized what

might be considered as a recognition of the importance of analyzing sentence complexity beyond that of length alone (13). What is suggested is a "kernel distance theory" in which the relative positions of the subject, predicate verb, and object are considered in the recognition that syntax can be altered and this will not show up in a count of sentence length. Sentences are deemed more difficult as the distance (counted in number of separating words) increases between the subject and the verb, between the verb and the object, and between the beginning of the sentence and the subject. As of now, this is an interesting hypothesis which needs empirical verification.

Based upon the evidence that certain grammatical constraints seem to provide more difficulty than others for pupils to process (7, 12, 17), the syntactic complexity measures attempt to give various weights to different elements of syntax. This allows for judging the difficulty of sentences containing similar elements in different positions within the sentences. However, some of the criticisms of standard formulas can be raised about syntactic complexity or sentence density measures. First, they do not measure readability under natural conditions, that is, the interaction between the reader and the written message is not sampled. Second, these measures do not take into consideration the context in which the sentences occur. Each sentence is analyzed without regard for the type of paragraph structure, organization, or function in which the sentences are grouped. Third, the sentence measures do not account for the factor of concept load. Although the

means used in standard formulas to estimate word difficulty is inadequate, formulas that rely solely on syntactical elements disregard this issue entirely. Fourth, the formulas at present are only heuristic. Little empirical evidence has been prcvided that indicates the assigned weights truly represent a real order of difficulty.

Other researchers have attempted to predict readability through the study of the effects of lexical density, the role of different types of grammatical units, and the difficulty of different transformations (7). For example, in one study (29), it was found that the diversity of lexical units (the number of different words used in a passage) and some estimates of the naturalness of language (measures of the ratios between the number of verbs and adjectives, and between the number of nouns and verbs and the number of adjectives) provided valid estimates of the difficulty of content area materials. It seems that lexical diversity reflects the density of ideas, details, or concepts within a passage. The greater the diversity, the greater the chance that the reader will lose information. In another study (15), it was shown that a combination of measures of lexical density together with measures of inter- and intra-sentence complexity were able to distinguish and predict comprehension scores across different subject matter areas. It seems that the combinations of factors which can predict readability of materials from different disciplines are not the same as those which can be used to predict differences in difficulty

within each discipline. Apparently, each discipline has its own set of factors for predicting reading difficulty. What may be more important, the various combinations of linguistic factors seemed to accurately predict differences in the difficulty of materials judged to be of equal difficulty by one popular standard formula.

There have been various studies to investigate the relative difficulty of different word classes as predictors of reading difficulty. Representative of these studies are two (25, 34) which reveal that young pupils seem to have more difficulty processing some conjunctions than others, and that young school pupils do not seem to integrate personal pronouns in the same way as adults.

In attempts to understand the effect of paragraph structure and organization on the readability of material, some researchers have studied the use of concept classification schemes and semantic models of prose for predicting the readability of materials (10, 30). And, in order to use some aspect of the reader-material interaction, at least one researcher has tried to develop a format for having the difficulty of passages predicted through the matching of target selections to a scale of passages with a predetermined order of difficulty (8). It seems that trained judges are able to match the target passages to a level of difficulty by subjectively considering the sentence patterns, the type and density of concepts, and the author's style in presenting ideas.

While these studies provide insights into factors that might be affecting the readability of passages, the insights have still been put to use only in attempts to predict readability. Predictions are only reliable when the characteristics of the reading material and reader population used in establishing the regression equation are similar to those of the material and pupils with whom one is working.

MEASURING THE DIFFICULTY OF TEXTS

A great deal of research has attempted to validate the cloze procedure (the systematic deletion of every nth word) as a means for estimating the readability of material (2, 3, 7). The rationale for its use is that the cloze procedure takes into account the interaction between and among the reader, the material, and the reading situation. The estimates of readability obtained through its use seem to be much more reliable than those obtained through the use of standard formulas. It is looked upon not as a predictor of readability but as an accurate measure of readability (32).

Since cloze procedure scores are percentages, some way had to be created for translating them into meaningful scores of readability. Recent research (3) has identified scores that represent a desirable level of performance on instructional materials that accounts for variables such as: (a) the reader's learning, retention, and transfer of information, (b) the reader's rate of reading and response, (c) the reader's preference for the subject matter, style, and difficulty of

the passage and willingness to study it, and (d) the effects on the reader's self concept and attitudes from having studied the material. Therefore, readability scores were shown to vary depending upon the grade level of the readers and the purpose for which the material was to be used (textbook reading, reference reading, or voluntary reading).

A variation of the cloze procedure has been developed that does not compare the reader's responses to the original material. Rather, the reader's responses are compared against all responses placed in the blanks by a criterion group (26). This procedure, called clozentropy, deems a word correct to the degree that members of the criterion group agree it is correct. The comprehensibility of the message is considered relative to a specific audience. This procedure seems to have great potential for intercultural communicators in that messages can be matched to a particular audience more effectively than ever before.

Although the cloze procedure measures readability, whereas formulas predict it, there are some cautions that must be considered when using it (31). First, cloze tests may contain many items for which there are no context clues. These items, then, may not be usable as discriminating items. Second, many deleted items are not reading related. The completion of those items reflects the reader's general background information and general language ability. Third, eventhough the cloze procedure has empirical validity, it does lack face validity. Fourth, cloze itmes may depend too much on short

range language and memory constraints. Fifth, the "every 5th word" deletion procedure may not be suitable for everyone. Finally, completion of the cloze items are greatly influenced by the type and number of deletions.

In part response to the last two criticisms, one group of researchers (28) is attempting to determine the deletion rate appropriate for different content areas. Preliminary evidence seems to show that science materials may need a greater space between deletions than does social studies or English materials. By varying the deletion rate within the different areas, the pupils' performances seem to be affected.

DETERMINING THE READABILITY OF INSTRUCTIONAL MATERIALS

The aim of this paper has been to present ideas that have implications for the effective selection of instructional materials. The evidence on readability research strongly suggests that the comprehension of a reader is affected by (1): (a) the content area being read, (b) the background of information required of the reader, (c) the author's writing style, (d) the vocabulary specific to the content area being read, and (e) the linguistic and morphological complexity with which the passages in the different content areas are generated. Evidence also seems to show that the use of counts of the number of words and syntactic elements may be ignoring the effect upon comprehension of where those elements occur within the sentences (2). Therefore, in order to capture the

"moment of readability" at which time a measure is taken of the interaction between characteristics of the reader and the written message under the influence of a particular instructional situation, the following recommendations are made:

1. Avoid the use of predictive formulas which usually have arbitrarily assigned grade equivalents or are capable of only establishing a rank order of difficulty according to some criteria. Although formulas will provide some indication of the relative difficulty of different materials in relation to each other, they will not provide useful information about whether or not those materials are readable by a group of pupils.

2. Use some form of the cloze procedure. The cloze procedure is the only available procedure which can take into account, in a natural setting, the constraints of the language system of the reading matter, the reading ability and other characteristics of the reader, and the background information needed by the reader. While it is usually considered expediant to count only "correct" responses (correct in relation to whether or not the author's specific language is accurately reconstructed), a count of items that are consistent in frequency and meaning with those of other members of the particular reading population can provide teachers with valuable information as to how the pupils can or cannot determine the author's message because of factors within their common linguistic or informational experiences. This

use of the clozentropy technique will allow teachers to adjust their measures of the various factors of readability to local instructional conditions.

3. Do not use the same criteria of success for all age groups, for all materials, and for all purposes. There are some established criteria available for use at different grade levels when reading for different purposes (3, 4). These can provide teachers with quick interpretations of cloze scores, provided the cloze procedure is used under the conditions recommended by that researcher. However, since evidence of other researchers indicates that cloze scores are also influenced by the number and type of deletions and by the content area, educators may find it useful to establish local criterion levels suitable for their instructional purposes and materials.

CONCLUSION

Instructionally, our purposes must always be to think of readability as ever changing. Our standards of what is readable and our judgments as to what is understandable should always be relative to a particular instructional situation. With our current knowledge of the factors that are interacting during an act of reading, it is inexcusable to rely solely upon some artificial and arbitrary means for classifying reading materials. We must always remember that when pupils are engaged in a reading situation, they bring not only knowledges and understandings of the content area and topic being

read, but also their anticipations and expectations of what are the purposes and objectives of the reading lesson. We should never eliminate the reader and the act of reading from our concept of readability.

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